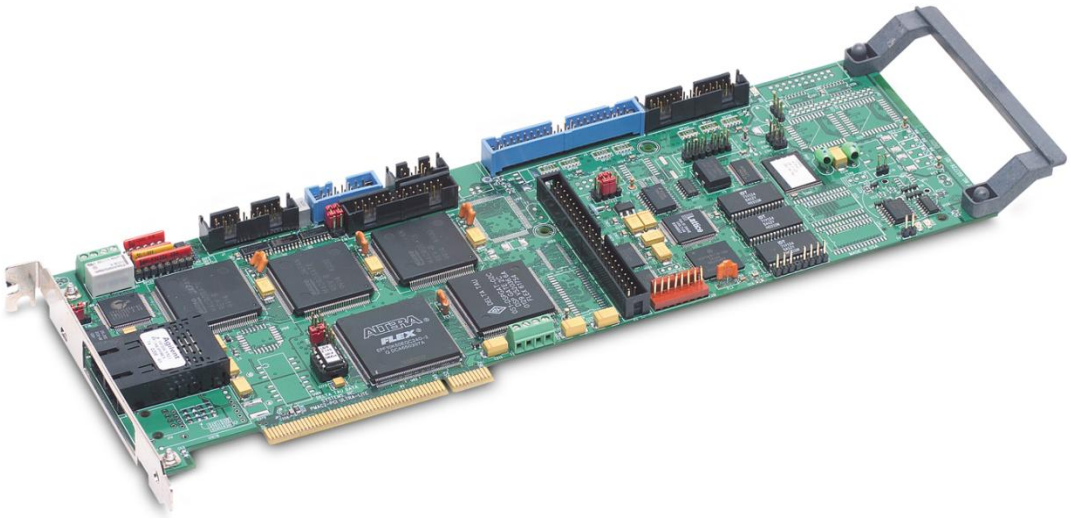
HARDWARE REFERENCE MANUAL

TURBO PMAC2 PCI ULTRALITE



Programmable Multi-Axis Controller

4AX-603726-XHXX

December 12, 2011

DELTA TAU
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Operating Conditions

All Delta Tau Data Systems, Inc. motion controller, accessory, and amplifier products contain static sensitive components that can be damaged by incorrect handling. When installing or handling Delta Tau Data Systems, Inc. products, avoid contact with highly insulated materials. Only qualified personnel should be allowed to handle this equipment.

In the case of industrial applications, we expect our products to be protected from hazardous or conductive materials and/or environments that could cause harm to the controller by damaging components or causing electrical shorts. When our products are used in an industrial environment, install them into an industrial electrical cabinet to protect them from excessive or corrosive moisture, abnormal ambient temperatures, and conductive materials. If Delta Tau Data Systems, Inc. products are directly exposed to hazardous or conductive materials and/or environments, we cannot guarantee their operation.

Safety Instructions

Qualified personnel must transport, assemble, install, and maintain this equipment. Properly qualified personnel are persons who are familiar with the transport, assembly, installation, and operation of equipment. The qualified personnel must know and observe the following standards and regulations:

IEC364resp.CENELEC HD 384 or DIN VDE 0100
IEC report 664 or DIN VDE 0110
National regulations for safety and accident prevention or VBG 4

Incorrect handling of products can result in injury and damage to persons and machinery. Strictly adhere to the installation instructions. Electrical safety is provided through a low-resistance earth connection. It is vital to ensure that all system components are connected to earth ground.

This product contains components that are sensitive to static electricity and can be damaged by incorrect handling. Avoid contact with high insulating materials (artificial fabrics, plastic film, etc.). Place the product on a conductive surface. Discharge any possible static electricity build-up by touching an unpainted, metal, grounded surface before touching the equipment.

Keep all covers and cabinet doors shut during operation. Be aware that during operation, the product may have electrically-charged components and hot surfaces. Control and power cables can carry a high voltage, even when the motor is not rotating. Never disconnect or connect the product while the power source is energized to avoid electric arcing.

WARNING

A Warning identifies hazards that could result in personal injury or death. It precedes the discussion of interest.

Caution

A Caution identifies hazards that could result in equipment damage. It precedes the discussion of interest.

Note

A Note identifies information critical to the user's understanding or use of the equipment. It follows the discussion of interest.

MANUAL REVISION HISTORY				
REV	**DESCRIPTION**	**DATE**	**CHANGE**	**APPROVED**
1	MANUAL CREATION	6/23/08	CP	JP
2	CORRECTED MACRO IC OPTIONS	9/12/11	SM	RN
3	UPDATED CPU OPTIONS REFURBISHED MANUAL	12/12/11	RN	RN

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INTRODUCTION

The Turbo PMAC2 PCI Ultralite is a member of the Turbo PMAC family of boards optimized for interface to the system through the MACRO ring and therefore does not contain on-board axis interface circuitry (which is what makes it Ultralite). It can command up to 32 axes through the MACRO ring. It can also support up to 32 channels of off-board axis interface circuitry through its expansion port, connected to ACC-24P or ACC-24P2 boards.

The Turbo PMAC2 PCI Ultralite is a full-sized PCI-bus expansion card. This card is capable of PCI bus communications, with or without the optional dual-ported RAM. Standalone operation is also possible and communications can be done through RS-232, RS-422.

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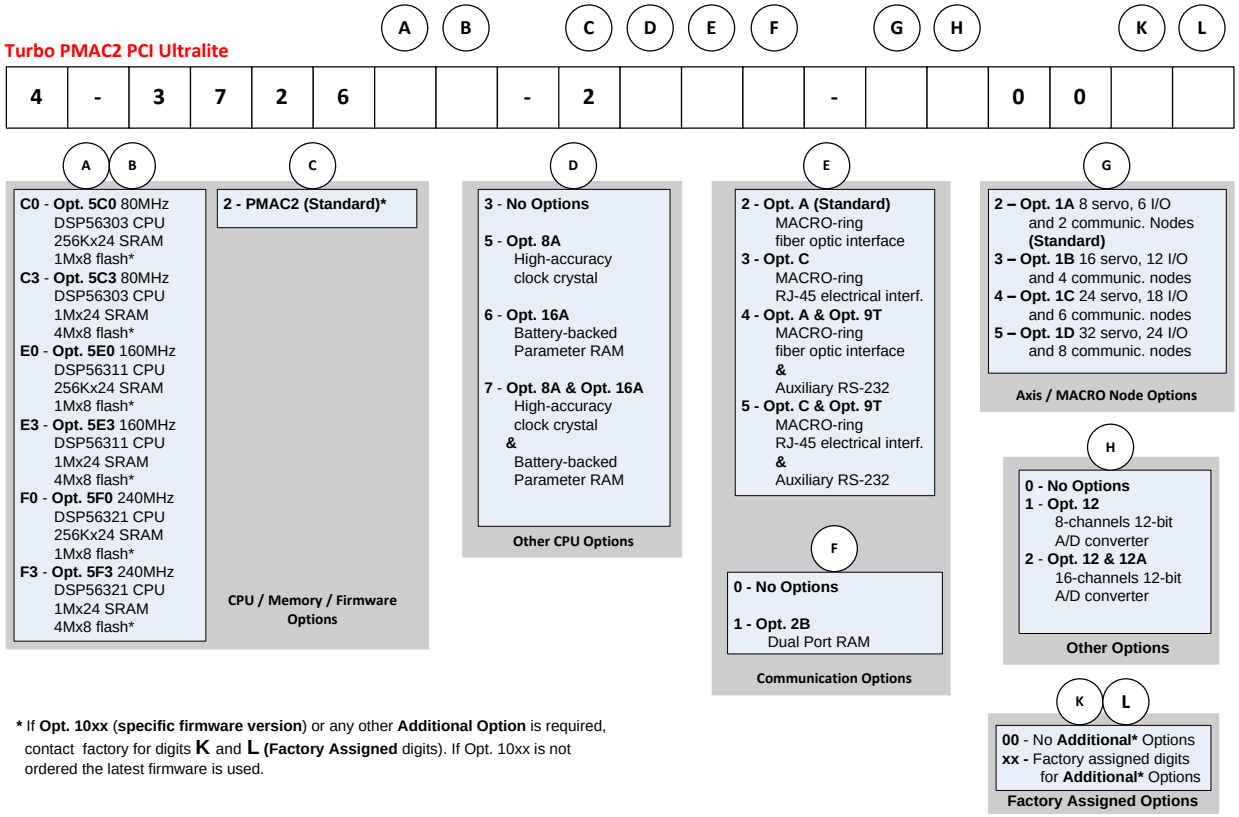
SPECIFICATIONS

Part Number And Options

The following is a summary of the part number and options available for the Turbo PMAC2 PCI Ultralite:


Turbo PMAC2 PCI Ultralite
A B C D E F G H K L
4 - 3 7 2 6 - 2 - 0 0
A B
C0 - Opt. 5C0 80MHz DSP56303 CPU 256Kx24 SRAM 1Mx8 flash*
C3 - Opt. 5C3 80MHz DSP56303 CPU 1Mx24 SRAM 4Mx8 flash*
E0 - Opt. 5E0 160MHz DSP56311 CPU 256Kx24 SRAM 1Mx8 flash*
E3 - Opt. 5E3 160MHz DSP56311 CPU 1Mx24 SRAM 4Mx8 flash*
F0 - Opt. 5F0 240MHz DSP56321 CPU 256Kx24 SRAM 1Mx8 flash*
F3 - Opt. 5F3 240MHz DSP56321 CPU 1Mx24 SRAM 4Mx8 flash*
C
2 - PMAC2 (Standard)*
CPU / Memory / Firmware Options
D
3 - No Options
5 - Opt. 8A High-accuracy clock crystal
6 - Opt. 16A Battery-backed Parameter RAM
7 - Opt. 8A & Opt. 16A High-accuracy clock crystal & Battery-backed Parameter RAM
Other CPU Options
E
2 - Opt. A (Standard) MACRO-ring fiber optic interface
3 - Opt. C MACRO-ring RJ-45 electrical interf.
4 - Opt. A & Opt. 9T MACRO-ring fiber optic interface & Auxiliary RS-232
5 - Opt. C & Opt. 9T MACRO-ring RJ-45 electrical interf. & Auxiliary RS-232
F
0 - No Options
1 - Opt. 2B Dual Port RAM
Communication Options
G
2 – Opt. 1A 8 servo, 6 I/O and 2 communic. Nodes (Standard)
3 – Opt. 1B 16 servo, 12 I/O and 4 communic. nodes
4 – Opt. 1C 24 servo, 18 I/O and 6 communic. nodes
5 – Opt. 1D 32 servo, 24 I/O and 8 communic. nodes
Axis / MACRO Node Options
H
0 - No Options
1 - Opt. 12 8-channels 12-bit A/D converter
2 - Opt. 12 & 12A 16-channels 12-bit A/D converter
Other Options
K L
00 - No Additional* Options
xx - Factory assigned digits for Additional* Options
Factory Assigned Options

***** If **Opt. 10xx** (**specific firmware version**) or any other **Additional Option** is required, contact factory for digits **K** and **L** (**Factory Assigned** digits). If Opt. 10xx is not ordered the latest firmware is used.

Environmental Specifications

Description	Specification
Operating Temperature	0°C -- 60°C 32°F -- 140°F
Storage Temperature	12°C -- 82°C 10°F -- 180°F
Humidity	10% -- 95%, non-condensing

Electrical Specifications

Description	Specification
Input Power	~2A @ +5V ~100 mA @ ±12V
Battery	3.0 V Lithium Cell, 1200 mAh, 2/3 A-size Or 3.6V Lithium Cell, 1000 mAh, 1.00" can

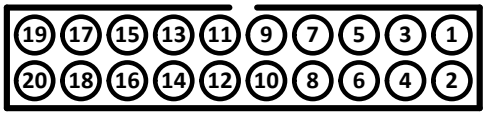
Note

Expected battery life is about 10 years with standard CPU options (5Cx). Faster CPU speed options (5Ex, and 5Fx) do tend to drain the battery faster, depending on the application demands.

CONENCTOR PINOUTS

J1: (JANA) Analog Inputs

The J1 (JANA) port provides optional eight or sixteen single-ended 12-bit analog inputs, using the traditional Option 12. These analog inputs can be used either in unipolar mode in the 0V to +5V range, or bipolar mode in the -2.5V to +2.5V range. Each input has a 470Ω input resistor in-line, and a 0.01 µF resistor to ground ensuing a 4.7 µsec time constant per input line.

J1: 20-pin IDC header (M) **Mating: 20-pin IDC header (F)**	**Front view** 

Pin #	Symbol	Function	Description	Notes
1	ANAI00	Input	Analog Input 1	0-5V or ± 2.5V input range
2	ANAI01	Input	Analog Input 2	0-5V or ± 2.5V input range
3	ANAI02	Input	Analog Input 3	0-5V or ± 2.5V input range
4	ANAI03	Input	Analog Input 4	0-5V or ± 2.5V input range
5	ANAI04	Input	Analog Input 5	0-5V or ± 2.5V input range
6	ANAI05	Input	Analog Input 6	0-5V or ± 2.5V input range
7	ANAI06	Input	Analog Input 7	0-5V or ± 2.5V input range
8	ANAI07	Input	Analog Input 8	0-5V or ± 2.5V input range
9	ANAI08	Input	Analog Input 9	0-5V or ± 2.5V input range
10	ANAI09	Input	Analog Input 10	0-5V or ± 2.5V input range
11	ANAI10	Input	Analog Input 11	0-5V or ± 2.5V input range
12	ANAI11	Input	Analog Input 12	0-5V or ± 2.5V input range
13	ANAI12	Input	Analog Input 13	0-5V or ± 2.5V input range
14	ANAI13	Input	Analog Input 14	0-5V or ± 2.5V input range
15	ANAI14	Input	Analog Input 15	0-5V or ± 2.5V input range
16	ANAI15	Input	Analog Input 16	0-5V or ± 2.5V input range
17	GND	Common		Tied to digital ground
18	+12V	Output	Reference	Reference voltage
19	GND	Common		Tied to digital ground
20	-12V	Output	Reference	Reference voltage

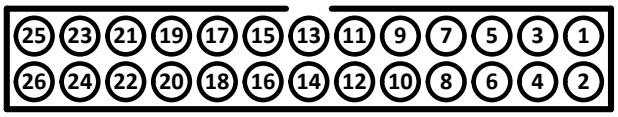
Using the J1 (JANA) analog inputs, the user should see:

Unipolar	
Input Voltage [VDC]	**Software Counts**
0	0
+2.5	+2048
+5	+4096

Bipolar	
Input Voltage [VDC]	**Software Counts**
-2.5	-2048
0	0
+2.5	+2048

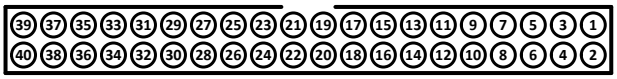
J2: (JTHW) Multiplexer Port

The J2 (JTHW) multiplexer port provides eight inputs and eight outputs at TTL levels. Typically these are used to create multiplexed I/O with accessory boards such as ACC-34 (Discrete I/O), to Opto-22 or similar hardware. J2 inputs/outputs may also be used directly as non-multiplexed discrete digital I/Os.

J2: 26-pin IDC header (M) **Mating: 26-pin IDC header (F)**				**Front view** 
Pin#	**Symbol**	**Function**	**Description**	**Notes**
1	GND	Common Ground		Tied to digital ground
2	GND	Common Ground		Tied to digital ground
3	DAT0	Input	Data-0 Input	Data input from MUX port accessories
4	SEL0	Output	Select0 Output	Address/data output for MUX port accessories
5	DAT1	Input	Data1 Input	Data input from MUX port accessories
6	SEL1	Output	Select1 Output	Address/data output for MUX port accessories
7	DAT2	Input	Data2 Input	Data input from MUX port accessories
8	SEL2	Output	Select2 Output	Address/data output for MUX port accessories
9	DAT3	Input	Data3 Input	Data input from MUX port accessories
10	SEL3	Output	Select3 Output	Address/data output for MUX port accessories
11	DAT4	Input	Data4 Input	Data input from MUX port accessories
12	SEL4	Output	Select4 Output	Address/data output for MUX port accessories
13	DAT5	Input	Data5 Input	Data input from MUX port accessories
14	SEL5	Output	Select5 Output	Address/data output for MUX port accessories
15	DAT6	Input	Data6 Input	Data input from MUX port accessories
16	SEL6	Output	Select6 Output	Address/data output for MUX port accessories
17	DAT7	Input	Data7 Input	Data input from MUX port accessories
18	SEL7	Output	Select7 Output	Address/data output for MUX port accessories
19	N.C.	N.C.		Not connected
20	GND	Common Ground		Tied to digital ground
21	BRLD/	Output	Buffer Request	Low is Buffer Request
22	GND	Common Ground		Tied to digital ground
23	IPLD/	Output	In Position	Low is In Position
24	GND	Common Ground		Tied to digital ground
25	+5V	Output	Reference	Power supply out
26	INIT/	Input	PMAC Reset	Low is Reset

J3: (JI/O) General Purpose Inputs And Outputs

The J3 (JI/O) connector provides 32 input/output pins at TTL 5V levels, direction controlled in software in byte-wide groups.

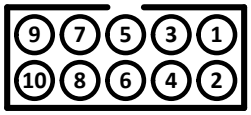
J3: 40-pin IDC header (M) **Mating: 40-pin IDC header (F)**				**Front view** 
Pin#	**Symbol**	**Function**	**Description**	**Notes**
1	I/O00	In/Out	Digital I/O 1	Software direction control.
2	I/O01	In/Out	Digital I/O 2	Software direction control.
3	I/O02	In/Out	Digital I/O 3	Software direction control.
4	I/O03	In/Out	Digital I/O 4	Software direction control.
5	I/O04	In/Out	Digital I/O 5	Software direction control.
6	I/O05	In/Out	Digital I/O 6	Software direction control.
7	I/O06	In/Out	Digital I/O 7	Software direction control.
8	I/O07	In/Out	Digital I/O 8	Software direction control.
9	I/O08	In/Out	Digital I/O 9	Software direction control.
10	I/O09	In/Out	Digital I/O 10	Software direction control.
11	I/O10	In/Out	Digital I/O 11	Software direction control.
12	I/O11	In/Out	Digital I/O 12	Software direction control.
13	I/O12	In/Out	Digital I/O 13	Software direction control.
14	I/O13	In/Out	Digital I/O 14	Software direction control.
15	I/O14	In/Out	Digital I/O 15	Software direction control.
16	I/O15	In/Out	Digital I/O 16	Software direction control.
17	I/O16	In/Out	Digital I/O 17	Software direction control.
18	I/O17	In/Out	Digital I/O 18	Software direction control.
19	I/O18	In/Out	Digital I/O 19	Software direction control.
20	I/O19	In/Out	Digital I/O 20	Software direction control.
21	I/O20	In/Out	Digital I/O 21	Software direction control.
22	I/O21	In/Out	Digital I/O 22	Software direction control.
23	I/O22	In/Out	Digital I/O 23	Software direction control.
24	I/O23	In/Out	Digital I/O 24	Software direction control.
25	I/O24	In/Out	Digital I/O 25	Software direction control.
26	I/O25	In/Out	Digital I/O 26	Software direction control.
27	I/O26	In/Out	Digital I/O 27	Software direction control.
28	I/O27	In/Out	Digital I/O 28	Software direction control.
29	I/O28	In/Out	Digital I/O 29	Software direction control.
30	I/O29	In/Out	Digital I/O 30	Software direction control.
31	I/O30	In/Out	Digital I/O 31	Software direction control.
32	I/O31	In/Out	Digital I/O 32	Software direction control.
33	GND	Common Ground		Tied to digital ground
34	GND	Common Ground		Tied to digital ground
35	PHASE/	Output	Phase Clock	For latching data
36	SERVO/	Output	Servo Clock	For latching data
37	GND	Common Ground		Tied to digital ground
38	GND	Common Ground		Tied to digital ground
39	+5V	Output	Reference	
40	+5V	Output	Reference	

J5: (RS-232) Serial Port

The J5 (RS-232) connector can be used as a primary communication mean or employed as a secondary port that allows simultaneous communication alongside PCI.
J5 can also be used to share phase and servo clocks between two or more PMAC cards. The J5A (RS-422) allows communication interconnection of multiple PMACs.

Caution

Pin #1 should NOT be connected if serial communication to the Turbo PMAC2 PCI Ultralite using J5 is tied to a modem style terminal emulator such as Microsoft Windows Terminal.

J5: 10-pin IDC header (M) **Mating: 10-pin IDC header (F)**			**Front view** 	
Pin#	**Symbol**	**Function**	**Description**	**Notes**
1	PHASE	In/Out	Phase Clock	
2	DTR	Bidirect	Data Terminal Ready	Tied to "DSR"
3	TXD/	Output	Receive Data	Host transmit data
4	CTS	Input	Clear to Send	Host ready bit
5	RXD/	Input	Send Data	Host receive data
6	RTS	Output	Request to Send	PMAC ready bit
7	DSR	Bidirect	Data Set Ready	Tied to "DTR"
8	SERVO	In/Out	Servo Clock	
9	GND	Common Ground		
10	+5V	Output	Voltage Reference	

The baud rate for the RS-232 serial port is set by variable I54. At power-up reset, The Turbo PMAC2 PCI Ultralite sets the active baud based on the setting of I54 and the CPU speed I52. Note that the baud rate frequency is divided down from the CPU's operational frequency. The factory default baud rate is 38400. This baud rate will be selected automatically on re-initialization of the Turbo PMAC2 PCI Ultralite, either in hardware using the re-initialization (E51) jumper or in software using the **$$$***** command.

To change the baud rate setting, set I54 to the corresponding value of desired frequency. Issue a **SAVE** and recycle power on the unit. For odd baud rate settings, refer to the Turbo Software Reference Manual.

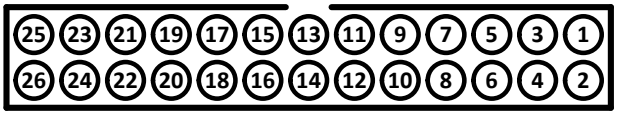
I54	**Baud Rate**	**I54**	**Baud Rate**
8	9600	12	38,400
9	14,400	13	57,600
10	19,200	14	76,800
11	28,800	15	115,200

Note

- I54=12 (38400 baud) is the factory default setting.
- SERVO and PHASE are outputs if jumper E1 is OFF; they are inputs if jumper E1 is ON.

J5A: RS-422 Auxiliary Serial Port

The J5A (RS-422) port provides the ability to communicate using both RS-422 and RS-232. In addition, this connector is used to daisy chain or interconnect multiple PMACs for synchronized operation (e.g. over 32 axes MACRO ring).

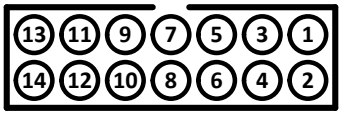
J5A: 26-pin IDC header (M) **Mating: 26-pin IDC header (F)**	**Front view** 			
Pin#	**Symbol**	**Function**	**Description**	**Notes**
1	CHASSI	Common	PMAC Common	
2	S+5V	Output	+5VDC Supply	Deactivated by E8
3	RD-	Input	Receive Data	Diff. I/O low true
4	RD+	Input	Receive Data	Diff. I/O high true
5	SD-	Output	Send Data	Diff. I/O low true
6	SD+	Output	Send Data	Diff. I/O high true
7	CS+	Input	Clear to Send	Diff. I/O high true
8	CS-	Input	Clear to Send	Diff. I/O low true
9	RS+	Output	Request to Send	Diff. I/O high true
10	RS-	Output	Request to Send	Diff. I/O low true
11	DTR	Bidirect	Data Terminal Ready	Tied to "DSR"
12	INIT/	Input	PMAC Reset	Low is Reset
13	GND	Common	PMAC Common	
14	DSR	Bidirect	Data Set Ready	Tied to DTR
15	SDIO-	Bidirect	Special Data	Diff. I/O low true
16	SDIO+	Bidirect	Special Data	Diff. I/O high true
17	SCIO-	Bidirect	Special CTRL.	Diff. I/O low true
18	SCIO+	Bidirect	Special CTRL.	Diff. I/O high true
19	SCK-	Bidirect	Special Clock	Diff. I/O low true
20	SCK+	Bidirect	Special Clock	Diff. I/O high true
21	SERVO-	Bidirect	Servo Clock	Diff. I/O low true
22	SERVO+	Bidirect	Servo Clock	Diff. I/O high true
23	PHASE-	Bidirect	Phase Clock	Diff. I/O low true
24	PHASE+	Bidirect	Phase Clock	Diff. I/O high true
25	GND	Common	PMAC Common	
26	+5V	Output	+5VDC Supply	Power supply out

Note

Jumpers E17 and E18 must connect pins 2 and 3 to use this port for serial communications.

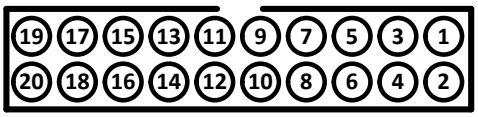
J6: (JDISP) Display Connector

The J6 (JDISP) connector is used to drive the 2-line x 24-character (ACC-12), 2 x 40 (ACC-12A) LCD, or the 2 x 40 vacuum fluorescent (ACC-12C) display unit. The Display command may be used to send messages and values to the display.

J6: 14-pin IDC header (M) **Mating: 14-pin IDC header (F)**			**Front view** 	
Pin#	**Symbol**	**Function**	**Description**	**Notes**
1	Vdd	Output	+5V Power	Power supply out
2	Vss	Common	PMAC Common	
3	Rs	Output	Read Strobe	TTL signal out
4	Vee	Output	Contrast Adjust. VEE	0 to +5 VDC
5	E	Output	Display Enable	High is enable
6	R/W	Output	Read / Write	TTL signal out
7	DB1	Output	Display Data	
8	DB0	Output	Display Data	
9	DB3	Output	Display Data	
10	DB2	Output	Display Data	
11	DB5	Output	Display Data	
12	DB4	Output	Display Data	
13	DB7	Output	Display Data	
14	DB6	Output	Display Data	

J7: (JHW) Handwheel Encoder Connector

The J7 (JHW) connector provides the interface for two quadrature encoders, typically to be used as handwheel or time base master encoders. It also provides two channels of pulse-and-direction or PWM top-and-bottom pair outputs.

J7: 20-pin IDC header (M) **Mating: 20-pin IDC header (F)**			**Front view** 	
Pin#	**Symbol**	**Function**	**Description**	**Notes**
1	GND	Common	PMAC Common	
2	+5V	Output	Reference voltage	Ok for Encoder Power
3	HWA1+	input	HW A+ Chan.	Also pulse input
4	HWA1-	input	HW A- Chan.	Also pulse input
5	HWB1+	input	HW B+ Chan.	Also direction input
6	HWB1-	input	HW B- Chan.	Also direction input
7	HWA2+	input	HW A+ Chan.	Also pulse input
8	HWA2-	input	HW A- Chan.	Also pulse input
9	HWB2+	input	HW B+ Chan.	Also direction input
10	HWB2-	input	HW B- Chan.	Also direction input
11	PUL1+	Output	PFM Pulse+	Also PWM output
12	PUL1-	Output	PFM Pulse-	Also PWM output
13	DIR1+	Output	PFM Direction+	Also PWM output
14	DIR1-	Output	PFM Direction-	Also PWM output
15	PUL2+	Output	PFM Pulse+	Also PWM output
16	PUL2-	Output	PFM Pulse-	Also PWM output
17	DIR2+	Output	PFM Direction+	Also PWM output
18	DIR2-	Output	PFM Direction-	Also PWM output
19	GND	Common	PMAC Common	
20	+5V	Output	Reference voltage	Ok for Encoder Power

TB1: Logic Power

Caution

This connector should not be used (connected) if the Turbo PMAC2 PCI Ultralite is installed in a PCI slot.

This terminal block can be used to provide the input power for the Turbo PMAC2 PCI Ultralite board for standalone operation, when it is NOT in a bus (PCI) configuration.

When the Turbo PMAC2 PCI Ultralite is mounted in a PCI slot, this terminal block should NOT be used. In this mode, the power is supplied automatically through the PCI connection.

Note

The TB1 connector is a 2-pin position in the standard configuration. However, if the analog inputs option (J1) is populated, then it is a 4-pin connector to allow for A/D converters power (±12VDC).

Pin #	Symbol	Function	Description	Notes
1	GND	Common	Reference Voltage	
2	+5V	Input	Positive Supply Voltage	Supplies all PMAC digital circuits
3	+12V	Input	Positive Supply Voltage	+12V to +15V
4	-12V	Input	Negative Supply Voltage	-12V to -15V

Note

The ±12VDC power is only used for the A/D converters, it is not necessary for powering-up PMAC.

TB2: Watchdog Relay

This terminal block provides the output for the watchdog timer relay, both normally open and normally closed contacts. This is usually used to connect to logic circuitry to bring the machine to a safe stop in case of a watchdog trip.

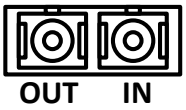
The normally-closed relay contact is closed while the Turbo PMAC2 PCI Ultralite is operating properly – it has power and the watchdog timer is not tripped – and open when it is not operating properly – either it has lost power or the watchdog timer has tripped.
The normally-open relay contact is open while the Turbo PMAC2 PCI Ultralite is operating properly, and closed when it is not operating properly (watchdog tripped).

Pin #	Symbol	Function	Description	Notes
1	WD_NC	Output	Watchdog Relay Out	Normally closed
2	COM	Input	Watchdog Return	+V or 0V
3	WD_NO	Output	Watchdog Relay Out	Normally open
4	COM	Input	Watchdog Return	+V or 0V

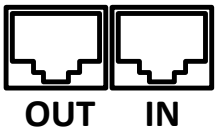
MACRO Interface Connectors

These connectors provide MACRO connectivity using either Fiber Optic, or RJ45 (optional).

Option A provides the MACRO-ring fiber optic SC-style interface connector. The fiber optic version of MACRO uses 62.5/125 multi-mode glass fiber optic cable terminated in an SC style connector. The optical wavelength is 1,300nm.

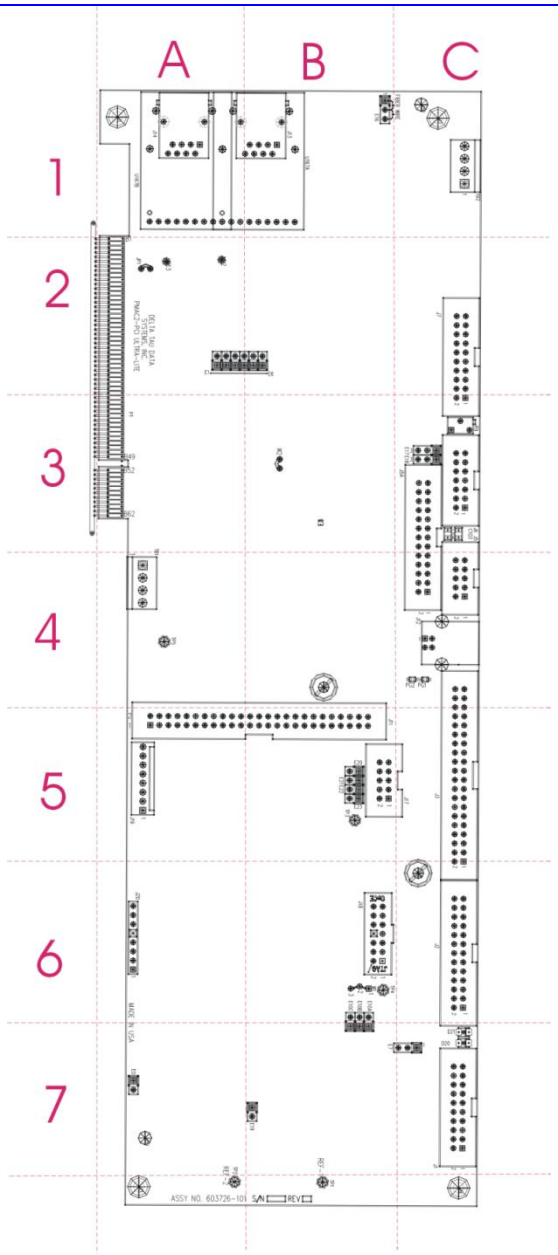
MACRO SC-Style Fiber Connector CN3 and CN4		**Front View** 
Pin #	**Symbol**	**Function**
1	IN	MACRO Ring Receiver
2	OUT	MACRO Ring Transmitter

Option C provides the MACRO-ring RJ-45 electrical interface connectors.

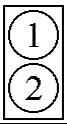
MACRO RJ45 Connector CN3 and CN4		**Front View** 
Pin #	**Symbol**	**Function**
1	DATA+	Differential MACRO Signal. CN4: DATA+ input. CN3: DATA+ output.
2	DATA-	Differential MACRO Signal. CN4: DATA- input. CN3: DATA- output.
3	Unused	Unused terminated pin.
4	Unused	Unused terminated pin.
5	Unused	Unused terminated pin.
6	Unused	Unused terminated pin.
7	Unused	Unused terminated pin.
8	Unused	Unused terminated pin.

E-POINT JUMPERS

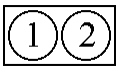
E-Point Jumpers on-board Location



E0: Reset Lock Enable

E-Point and Physical Layout	Location	Description	Default
E0 	A-7	Remove jumper for normal operation Jump pins 1 to 2 to force the card to stay in the reset state.	No jumper installed

E1: Card 0 (Clock Direction) Select

E-Point and Physical Layout	Location	Description	Default
E1 	A-2	Remove jumper to specify that this PMAC is Card 0, which generates its own phase and servo clock (default). Jump pins 1 to 2 to specify that this PMAC is not Card 0, but Card 1 to F (15), which requires external phase and servo clock signals from the serial port to operate.	No jumper installed

E2: 40/60 MHz Operation

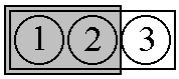
E-Point and Physical Layout	Location	Description	Default
E2 	A-2	Remove jumper. Jump pins 1 to 2.	No jumper installed

E3: Re-Initialization on Reset Control

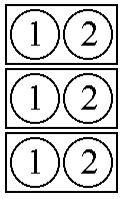
E-Point and Physical Layout	Location	Description	Default
E3 	A-2	Remove jumper for normal reset mode (default). Jump pins 1 to 2 for re-initialization on reset.	No jumper installed

E4-E6: (Reserved for Future Use)

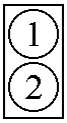
E7: Analog Input Reference Select

E-Point and Physical Layout	Location	Description	Default
E7  	B-7	Jump E7 pin 1 to 2 to select normal use of ANAI15 (pin 16 of JANA-J1). Jump E7 pin 2 to 3 to select user-supplied reference on pin 16 of JANA-J1 for OPT12 inputs.	Pins 1 – 2 jumpered

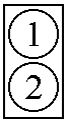
E10A, B, C: Flash Memory Bank Select

E-Point and Physical Layout	Location	Description	Default
E10A  E10C	B-6	Remove all three jumpers to select flash memory bank with factory-installed firmware. Use other configuration to select one of the 7 other flash memory banks	No jumpers installed

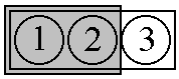
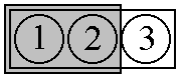
E15: Internal/External MACRO Electrical Select

E-Point and Physical Layout	Location	Description	Default
E15  		Jump JP3 pin 1 to 2 to disable internal loopback MACRO communications and permit true electrical MACRO communications. Remove JP3 jumper to select internal loopback MACRO communications (for test purposes only)	Jumper installed

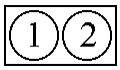
E16: Electrical/Optical MACRO Input Select

E-Point and Physical Layout	Location	Description	Default
E16  	B-1	Jump E16 pin 1 to 2 to select MACRO input from fiber optic receiver. Remove E16 jumper to select MACRO input from electrical RJ45 receiver.	Jumper installed (Option A) No jumper installed (Option C)

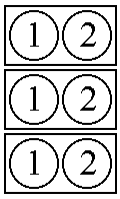
E17 – E18: Serial Port Select

E-Point and Physical Layout	Location	Description	Default
E17  	C-3	Jump E17 pin 1 to 2 to select RS-232 serial data input from J5. Jump E17 pin 2 to 3 to select RS-422 serial data input from J5A.	Pins 1 – 2 jumpered
E18  		Jump E18 pin 1 to 2 to select RS-232 serial handshake input from J5. Jump E17 pin 2 to 3 to select RS-422 serial handshake input from J5A	Pins 1 – 2 jumpered

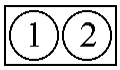
E19: Watchdog Disable Jumper

E-Point and Physical Layout	Location	Description	Default
E19  	B-7	Jump pin 1 to 2 to disable Watchdog timer (for test purposes only). Remove jumper to enable Watchdog timer.	No jumper installed

E20 – E22: Power-Up/Reset Load Source

E-Point and Physical Layout	Location	Description	Default
E20  E22	B-5	Remove jumper E20; Jump E21 pin 1 to 2; Jump E22 pin 2 to 3; To read flash IC on power-up/reset Other combinations are for factory use only; the board will not operate in any other configuration.	No E20 jumper installed; E21 and E22 jump pin 1 to 2

E23: Firmware Reload Enable

E-Point and Physical Layout	Location	Description	Default
E23  	B-5	Jump pin 1 to 2 to reload firmware through serial or bus port Remove jumper for normal operation.	No jumper installed